



Lessons From Macondo: The Senior Management Walkaround

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Deepwater Horizon

- Deepwater Horizon was an ultra-deepwater, semi-submersible offshore oil drilling rig, built in 2001 by Hyundai Heavy Industries for Transocean. Transocean, a major offshore drilling rig operator, was contracted by BP to drill on the Macondo Prospect (a BP-leased property in the Gulf of Mexico). BP purchased drilling rights to the Macondo Prospect in 2008. In February, 2010, the rig's crew commenced drilling beneath approximately 5,000 feet of water at the Macondo Prospect.

Drilling and Sealing

- During drilling, well pressure is maintained by injecting a heavier-than-seawater mud into the shaft. Otherwise, the thin shale at the bottom of the shaft would crack from the upward pressure of the hydrocarbons.
- After finishing a well, a heavy lining is inserted and bonded to the sides of the shaft with cement to prevent hydrocarbons from leaking into the well. Then an equal amount of seawater is used to replace the mud.
- To verify that a seal is operational, well pressure is temporarily reduced to check if fluids flow out the top of the well, which would indicate pressure increasing from below. If all of the mud is removed while the well is flowing during the pressure reduction, the well could blow.

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What Happened

- Seven hours before the blowout, executives boarded for a management visibility tour to communicate occupational safety messages and congratulate the crew for accruing a total of 7 years without a lost time injury.
- Even though a high-energy drilling process was occurring, process safety was not on the agenda.
- The executives testified that they witnessed confusion and debate between rig personnel concerning negative pressure testing and suggested that they move on to stop distracting rig personnel and have an on-site rig manager stay behind to help.
- As the mud was replaced with seawater, simultaneous operations distracted the crew from monitoring the readings, which showed that oil was leaking into the bottom of the well. This occurred 43 minutes before the blowout.
- The executives (all former rig managers or offshore drilling experts) knew that the workers were removing one of the last barriers against blowout, but they did not audit that practice, even though Transocean suffered a blowout in the North Sea 4 months earlier. That blowout garnered a 10-page advisory against complacency in flow monitoring and was circulated within the company. The executives testified they were unaware of the North Sea event.

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What Happened (cont.)

- At approximately 9:45 p.m. Central Daylight Time, methane gas expanded in the well pushed drilling mud up the 35,000-foot well and out of the degasser system. The gas flowed up and exploded. The devastation took the lives of 11 rig workers. The 4 executives and 111 rig workers were rescued. Approximately 4.9 million barrels of oil were spilled before the well was finally controlled.



An unsuccessful attempt to plug the well using a technique known as "top kill." Source: U.S. Coast Guard

Proximate Cause

- High-pressure methane gas from the well expanded up through the well, riser, and into the rig where it ignited and exploded.

Underlying Issues

- Eight major investigations listed more findings than this study can recount. This specific study focuses solely on the executive walkaround and the lack of focus on the safe operation of the complex system. The tour presented a potential for extra scrutiny during operations. Had the executives been prepared to audit and intervene, their expertise could have formed the layer of protection that prevented the blowout.

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Focus on Physical Hazards Instead of System Safety

- Hopkins found that despite their engineering experience, the executives' focus was on workplace safety, not process safety. Multiple interviews and investigative sources showed that auditing material conditions was easier than analyzing crew and manager behavior.
- Furthermore, the executives did not want to interfere with rig operations. Executives interviewed after the disaster said that they did not want to undermine the authority of the managers aboard the rig, or cast doubt upon the professionalism of the crew.
- The small amount of process safety incidents that do occur, such as blowouts and kicks, do not contribute to annual workforce safety statistics. BP and Transocean measured corporate and subcontractor operational safety on traditional lost time and total case injury rates—the exact effects that a management tour focus on material conditions would mitigate (and quantify in minutes of drilling operations).
- The senior health and safety manager for BP drilling operations testified after the blowout, stating that safety for him involved hazards and risks to individual workers carrying out tasks; and that engineers were responsible for process safety.

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Aftermath

- Deepwater Horizon burned for almost 36 hours and finally sank on April 22, 2010, nearly a mile deep and 1,300 feet northwest of the well it drilled. Oil seeped from the well for 87 days until it was temporarily capped on July 15, 2010. Relief wells were finally used to seal and kill the blown well on September 19, 2010.
- Even now, analysts report that the aftermath of litigation, damages, and recovery (which are currently unknown) will continue to take years to resolve. At this time, the Macondo blowout is considered the worst offshore oil spill in history. Damages paid for claims, advances, and settlements, have since crested \$42.2 billion and may continue to rise.

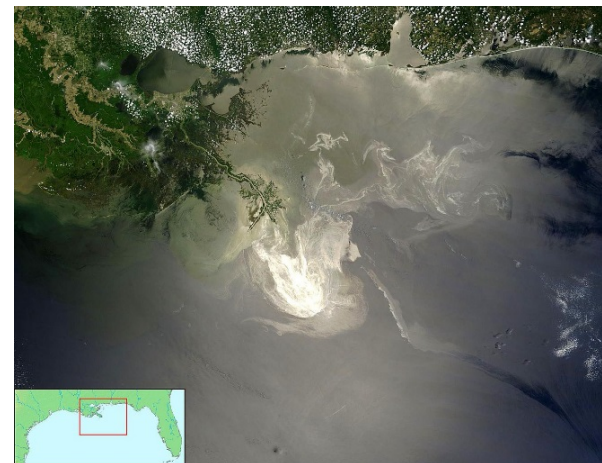


Oil from the Deepwater Horizon oil spill approaches the coast of Mobile, Alabama, on May 6, 2010. Source: U.S. Navy

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Relevance to NASA

- Hopkins avoids judging the BP and Transocean executives' actions in hindsight—recommending moving forward proactively with planning and preparation.
- The executives had experience with offshore operations, but many senior figures may not—necessitating the use of a translator or adviser with the right expertise during visits to high-energy facilities. Having the necessary knowledge facilitates inquiries and analysis of system operations.
- A senior management walkaround is a matchless opportunity to not only audit, but to send a message: high-energy systems deserve constant vigilance. Everyone present owns some measure of risk per their authority and capability. Given expert preparation, the senior manager or executive can demonstrate care for the crew and the public, even intervening in all but the most time-critical arenas (where qualified operators must decide and execute in minutes and seconds). A senior manager can—with enough systems knowledge or expert advise—can recognize a deteriorating situation by monitoring defenses. Just by being present, that manager becomes responsible for stopping perceived unsafe work, until the situation is clarified or the actual risk is reduced to an acceptable level.



Sunlight illuminated the lingering oil slick off the Mississippi Delta on May 24, 2010. Source: NASA